A FISH FARM.

BY E. DEXTER.

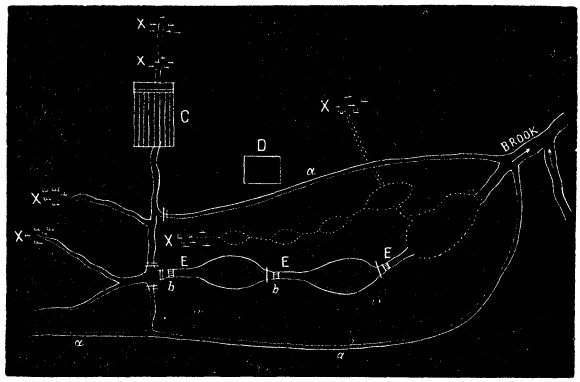


Fig. 39.*

THE Fish-hatching establishment at West Barnstable was begun in the spring of 1868. The experiments have as yet been confined mostly to trout, of which we have hatched this year some 60 000, as well as 2000 salmon ova which were procured in New Brunswick by the State Commissioners of Fisheries, by whom they were presented to us. As the process of hatching goes on during the transport of the eggs in wet moss, we lost several by their hatching on the way in the cars.

The place selected for building the ponds to contain the parent trout, was a swampy piece of land at the head of a brook of considerable size, running into the salt water after a course of a mile and a half or two miles, and containing a half dozen or more pure springs, the waters of which formed

* EXPLANATION OF FIG. 39.—X, X, X, X, X, X, springs. *a*, *a*, *a*, drains. C, hatching house. D, represents a series of ponds for young fish. E, E, E, spawning ways. *b*, *b*, plank troughs. The two ponds between E, E, E, are for spawning fish. The large pond represented by dotted lines, on the right of this, is used as a reservoir for fish. The dotted lines on the cut above the ponds represent a proposed series of ponds. A tank is also placed at this point, indicated by the X on the left of this series of proposed ponds.

the fountain head of the stream. Two ponds have thus far been made by excavation, each about forty feet long by twenty feet wide, and from three to four and a half feet deep. They are connected together, the same water being used for both ponds. The supply of water is about eighteen square inches, and is taken from tanks made of plank, varying in size from ten to fifteen feet in length, and from four to ten feet in breadth, sunk in the soft mud at the points where the springs came to the surface, and as deep as was necessary to reach the substratum of sand, which was generally about five feet. These tanks have no bottom planks, and the water wells up through the sand at the bottom, forming reservoirs of living water of even temperature, summer and winter, and not subject to freshet or variation in quantity. The temperature of the springs varies but little from 48° throughout the year.

There are now about seven hundred parent trout in the two ponds, ranging from three-quarters of a pound to three pounds in weight. It is calculated that the first pond will sustain over 2000 fish of the larger size, while in the second three times that number of smaller fish will thrive. This is allowing one large fish or three of the smaller size to the cubic foot.

They are fed daily with live minnows and shrimp caught on the adjacent salt marshes, or, when they cannot be conveniently obtained, with chopped liver, the roe of codfish, etc. The ponds are stoned, and one of them which was built in low wet land, is cemented on each side of the stones. Having learned by former experience that trout will spawn in the pond, and the ova thus be lost if its bottom is sandy or gravelly, we covered the bottom, where its nature seemed to invite the fish to this operation, with flat stones, thus obviating the difficulty so far as we have observed. Aquatic plants, mosses, etc., were introduced and now cover the bottom, not only providing a large amount of food in the form of crustacea, snails, etc., but also supplying to the water

the necessary chemical elements which are being constantly exhausted by the respiration of the fish.

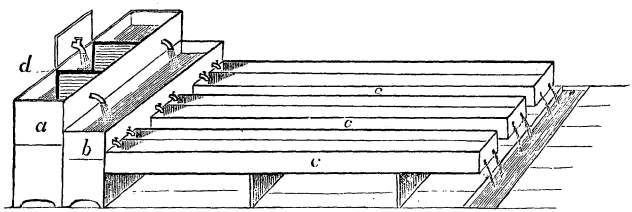
The water enters each pond through a plank trough, the sides of which are sunk nearly to the level of the ground. These troughs are fifty feet long and three and a half feet wide, and are filled to the depth of six inches with coarse gravel, over which there are six inches of water flowing with a slight current to the ponds. As it is the habit of the trout to seek shallow running streams to spawn, they eagerly resort to these *spawning ways* when ready, and are taken by closing the bottom of the way, and driving the fish into a bag net at its entrance into the pond. They are then removed in tubs of water to the *hatching house*, for the purpose of taking the ova from the female and impregnating them with the milt of the male fish. The modus operandi is as follows: The female fish is grasped with one hand by the back and shoulders, the vent being held under the surface of the water in a tin pan or other vessel partly filled, while with the other hand the abdomen is gently rubbed or pressed toward the vent. If the ova are mature and ready to be shed, a slight pressure is sufficient to extrude them. The same operation is then gone through with the male; if his milt is mature, it will flow in a small quantity into the vessel. A few drops are sufficient to impregnate thousands of eggs. The milt and the ova are then gently stirred together, and allowed to remain undisturbed for five or ten minutes. The water is then poured off, new water is gently admitted to wash the eggs, and they are ready to be placed in the hatching troughs.

It may be as well to state here that the spawning time for trout is from October till March, the principal spawning months being November and December. It is generally calculated that a trout weighing one pound will produce 1000 eggs; the larger and smaller ones in the same general proportion. I have known, however, during the past season, a trout of less than half a pound in weight, to deliver 1000 eggs by actual count.

The first requisite now is a supply of pure *spring* water for hatching the eggs,—neither too warm nor too cold. From 45° to 50° is the best. Every degree warmer or colder will make from six to eight days difference in the time of hatching. From 37° to 54° is considered the limit within which to hatch trout. By a calculation in Mr. Norris' book ("American Fish Culture"), it will take one hundred and sixty-five days with water at 37°, and thirty-two days with water at 54°.

The hatching house in the establishment we have spoken of is a wooden building twenty feet long by twelve feet

Fig. 40.



wide, into which water is admitted about three feet above the level of the floor, from springs immediately in the rear, enclosed in sunken tanks as before described, and covered so as to be out of reach of cold or heat. To enable the water to be brought in at this height from the floor, the house is sunk three feet in the ground, and the boards are covered with a heavy coat of pitch inside and out, to a point above the level of the surrounding ground to prevent their rotting. The amount of water now used in the house is what will flow through two faucets, one inch in diameter, with a moderate pressure. This is led in the first instance into a *straining trough* (Fig. 40, *a*), running across the width of the building, where it passes through flannel strainers (*d*) to insure its purity. It then flows into a *distributing trough* (*b*), which is parallel to the straining trough and a few inches lower, from which, by means of faucets, it is let on to the *hatching troughs* in such quantity as may be best.

The hatching troughs (Fig. 40, *c*) are placed at right angles to the others, and are sixteen feet long, fifteen inches wide, and eight inches deep, and are six in number with covers upon hinges, the top of them being about fifteen inches from the floor. They are lined with slate, one-half of an inch thick, upon the sides and bottom, with transverse subdivisions; every two feet made of the same material and two inches in height. A fungus growth, very detrimental to the ova, is unavoidable when wood only is used. The bottom of the troughs is covered with about one inch of moderately fine gravel, and over it flows a constant stream of screened spring water about an inch deep, the lower end of the trough being depressed two inches. On this gravel the impregnated ova are placed in a single layer. In about three weeks the eyes can be seen in the impregnated eggs, appearing simply as two black specks; the blood-vessels of the future fish may also be seen, and from this time its development may be traced daily in the shell. With the temperature of the water at 48°, we may look for the hatching of the ova from the forty-fifth to the fiftieth day. A trout just hatched is about three-eighths of an inch in length, and has attached to it an umbilical sac of several times its own bulk, which sustains the young fish for about forty days, when it is absorbed. The young fish may now be let out into the waters it is desired to stock. They will thrive if placed in a brook even at this early age, such waters supplying an abundance of minute particles of food. If reared in confinement, however, they must be fed with raw liver chopped to the consistency of blood and mixed with water, with the yolk of eggs grated very fine and treated in the same way, or thin sour curds. The latter food is perhaps the best as it sinks more slowly, and trout seize their food *in transitu*, paying little attention to it after it reaches the bottom.

We have sought only to give such a general description of a fish breeding establishment, and of the habits and treat-

ment of the fish, as would give some idea of the practical parts of the art of pisciculture. There are many details connected with the subject which we have not touched upon. They can be found very thoroughly treated of in any of the modern works on pisciculture, of which Norris' "American Fish Culture" is the latest and most practical.

In the above all general considerations have been avoided. It would, perhaps, have been as well to have stated that the arguments in favor of artificial hatching of eggs is based on the small proportion of them that are hatched when deposited in a stream, by the fish following the course of nature, and the very large proportion when hatched by artificial arrangement. The many enemies of fish spawn (other fish, water insects, birds, rats, not to speak of sediment, freshets, ice, etc., etc.) reduce the number of the eggs sadly. It has been calculated by English pisciculturalists that not one salmon reaches the proper size for the table out of every thousand eggs deposited in the stream. As the salmon migrates to the sea when weighing only a few ounces, it would, however, be more subject to casualty than the trout.

THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.

(Continued from page 136.)

We have seen that the aquarium is to be distinguished from the common fish-globe by its self-supporting character. We have examined in a general way the philosophy of the aquarium and concluded that the rectangular tank was the most useful one to have. Let us now look for a situation for the tank before the specimens are placed within it. It is desirable that the sun should shine upon the tank for at least an hour during the day; an eastern or southern aspect